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EDITORIAL.

Seasonal Effect on Poultry.

In temperate countries the effects of climate on the condition of poultry are fairly well known. Seasons there are well defined and hatching is commonly regulated to ensure that pullets come into lay during the autumn months when they would otherwise tend to moult and cease laying. Malayan seasons, however, are determined by rainfall, not by temperature, and some of the effects of these different conditions have been studied at the School of Agriculture at Serdang in relation to Rhode Island Red and other fowls and are the subject of a somewhat provocative article in this number.

The observations at Serdang show that wet weather has a depressing effect on poultry and, in the case of pure and half-bred Rhode Island Reds, may lead to general loss of condition and fecundity. The general impression which the author gathers is that pure-bred and upgraded birds lack the necessary stamina to resist these adverse weather conditions. The symptoms, he states, normally follow a definite sequence: egg production declines to a marked degree, appetite falls off, layers become anaemic and listless, the majority of them go into a moult, and the mortality rate tends to increase. The severity of the effect varies from year to year; in one year it was comparatively slight while the following year it was so serious that it was still noticeable in the breeding pens some 18 months later.

The author considers it unsatisfactory to attribute this loss of condition merely to "lack of stamina" and asks just what climatic factor or factors are involved. In view of the fact that domesticated fowls are easily frightened into a moult, with a consequent reduction in egg production, he suggests the possibility that thunderstorms may constitute the causal factor in this particular instance.

The data produced in this article in support of the author's theory are interesting but, inevitably at present, inconclusive. We appear to be faced with the fact that adequate information is not available on the physiology of the domestic fowl, and it might well be that a more detailed study of this subject would lead to important discoveries and help materially in the problem of improving poultry in tropical countries. The task, however, would be a big one and is at present beyond the powers of the School to undertake.

While the problem is thus of undoubted importance, it should not be regarded as critical and any tendency to alarm should be deprecated. Records over some 5 years or more at the School show that, under good conditions of feeding and general management, native flocks have averaged 125 eggs of 1½ ozs. each — say 187½ ozs. of egg — per bird per annum with an average mortality from all causes of 8 per cent; that pure-bred R.I.R's under the same conditions (but eating more food, of course) have averaged 163 eggs of 1 7/8 ozs. — say 306 ozs. of egg — per bird per annum, in spite of an average mortality of 21 per cent; and that first-cross flocks have averaged 160 eggs of just over 1½ ozs. — say 250 ozs. of egg per bird — per annum, with an average mortality of 8 per cent. Despite these seasonal upsets, therefore, it is clear that pure R.I.R.'s and upgraded fowls can produce a considerably higher egg-yield than native fowls. It has still to be proved that comparable increases can be secured at economic rates under *kampong* conditions of management, but there is at present no justification whatever for any radical change in Departmental poultry policy, which is to encourage upgrading by distributing pure-bred Rhode Island Red cockerels at reasonable rates.

Feeding Pigs with Fish Refuse.

Pig rearing is an important adjunct to agriculture in Malaya and the Department of Agriculture has for some time studied the question of providing a balanced ration for the animals with due regard to the economic aspect of this question. Thus, in recommending a ration, the fullest local use possible must be made of waste products which, while available at a cheap price in one area, may be unobtainable in another part of the country.

In this connexion feeding trials have been carried out in Penang to supply the necessary minerals and most of the protein of the ration by the use of *"ikan busok"* which is the small, unsuitable and damaged fish from the local fishing industry. *"Ikan busok"* is sold both fresh and salted, so that it was necessary to duplicate the trials to include both forms of this foodstuff.

This investigation is described in an article on another page of this issue in which the author concludes that either dried or salted *"ikan busok"* may be fed to swine to replace groundnut cake and minerals in balanced rations without any adverse effect in the quality of the meat, and without reduction in the live-weight gains of the animals as compared with pigs fed on the balanced rations.

While there is little if any financial advantage in using *"ikan busok,"* its use is favoured by the Chinese pig keepers as it simplifies the purchase and mixing of rations. It may also be recommended for the reason that it converts a waste product into a highly nutritious human food and replaces groundnut cake which is an imported product.

We must, however, again emphasize the fact that on the evidence at present available the substitution of *"ikan busok"* for groundnut cake is recommended only when the price of the former ingredient justifies its inclusion in the ration.

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It has been the policy of *The Malayan Agricultural Journal,* since its inception, to confine the advertisement pages to subjects having a decided bearing on agriculture in this country; in this way we enhance the value of our Journal alike to our advertisers and to our readers.

We therefore invite readers to study our advertisement pages with the same care that they read other parts of the Journal. We would add that we shall be grateful if, in writing to advertisers, mention is made of the fact that the advertisement was seen in *The Malayan Agricultural Journal.*

SEASONAL LOSS OF CONDITION IN RHODE ISLAND RED AND OTHER FOWLS IN MALAYA

By
G. E. Mann,
Principal, School of Agriculture, Malaya.

Domesticated fowls are usually very sensitive to their environment. Thus, if the system of housing or feeding is suddenly changed or if the birds are frightened, by rough handling for example, they tend to moult and — in the case of layers — egg production falls off and may even cease altogether for a period which may last as little as a week or two but may in obstinate cases extend over some months.

Climate a Part of Environment.

Weather conditions play an important part in environment. They are beyond our direct control but their effects can be regulated to some extent by artificial means which, if applied to poultry husbandry, must be kept cheap and simple. In temperate countries, fowl-houses can be so designed as to be adjustable for summer and winter conditions while a deficiency of sunlight in winter can be overcome by installing ultra-violet lamps or by including cod liver oil in the diet. In temperate countries, too, where the seasons are more or less well defined and chickens display a natural tendency to moult in the late autumn, a fair measure of control can be secured by selecting an appropriate season for hatching with a view to getting pullets to come into lay during the autumn months. Given sound management in other respects, the moult is then largely averted, most of the flock continues to lay without interruption and the farmer secures the advantage of the pullet flush at a time of high prices.

Climate of Malaya.

The climate of Malaya differs considerably from that of the temperate zones. Here, the seasons are governed by the monsoons. The land surface is comparatively small and is almost completely surrounded by a vast expanse of ocean; temperature therefore varies comparatively little throughout the year and there is no winter or summer in the generally accepted sense of the words. Instead, one finds a cycle of wet and dry seasons. According to Stewart(1), the N.E. monsoon begins in October or November and continues until March, while the S.W. monsoon extends from May to August. The latter monsoon, however, does not affect the whole Peninsula, for the prevailing wind south of a line running approximately from Malacca in the west to Pekan in the east is S.E., not S.W. The rainfall effects of these changes in the prevailing winds may be summarized roughly as follows —

East Coast (extending about 20 miles inland):—
Maximum rainfall about December.
Minimum rainfall about July.
West Coast (excluding Malacca to Port Dickson) *and Interior*:—
Maximum rainfall about April and October.
Minimum rainfall about January and July.
Malacca to Port Dickson:—
Maximum rainfall about August. Rain also about October.
Minimum rainfall about January.

Monthly rainfall records at Serdang since January 1936 are shown graphically in Figure I. Unfortunately, it is not possible to add reliable records of thunderstorms at Serdang; the nearest place at which such records are kept is Kuala Lumpur, some 10 miles away as the crow flies, and this distance is probably too great to give a fair indication of thunderstorms at Serdang. Such storms are usually very localized in Malaya and one storm right overhead at Serdang might conceivably have far more serious effects than half a dozen storms a few miles away. It can, however, be stated that wet seasons in Malaya are generally accompanied by an increase in the incidence of thunderstorms.

Seasonal Effects on Fowls at Serdang.

The effects to be described in this article have been observed at the School of Agriculture, Serdang, over the past 4½ years and normally occur whenever a wet season succeeds a dry one. This suggests, but no definite claim is made at present, that the wet weather is causal. The symptoms follow a definite sequence. Soon after wet weather sets in, egg production declines to a marked degree, appetite falls off, the layers become anaemic and listless, the majority of them go into a moult, and the mortality rate increases, although numbers are usually too small to be regarded as definitely significant. Moreover, much of this mortality is from undiagnosed causes. The observed fluctuations in egg-production and undiagnosed mortality are recorded in Table I and in Figures II, III and IV for pure-bred Rhode Island Reds, half-bred R.I.R's, and native (*i.e.* Malay *kampong* and Canton) fowls respectively. Egg-production is recorded as a percentage of possible production, one egg per layer per diem being taken as 100 per cent., while mortality is expressed as a percentage of the total number of layers under observation. Most of the survivors come back into lay in due course, although some take a considerable time to do so; but, even when they have apparently recovered condition, the depressing effect of the wet weather may still be observed in the form of poor fertility and particularly poor hatchability. Judging by the records at Serdang, native fowls suffer but little in comparison with pure and half-bred Rhode Islands — possibly because the former are acclimatized, possibly because they are by nature poor layers and egg production thus throws less strain on their physique, leaving them more capable of resisting adverse weather conditions. With pure and half-bred R.I.R's, loss of condition

in the flock as a whole is often serious, although an occasional bird may be affected slightly or not at all. The severity of the effect varies from year to year in a most capricious way. Thus, the wet season at the end of 1937 and 1940 did comparatively little damage at Serdang whereas that at the end of 1938 was so serious that its effects were still noticeable in the breeding pens some 18 months later. In fact, the greatest difficulty was experienced throughout 1939 in maintaining even a fairly satisfactory breeding pen of pure Rhode Islands.

These seasonal effects at Serdang are summarized for convenience in Table II. In making the very brief comments therein concerning egg production and mortality, the author has endeavoured to allow for two factors which are not indicated by the graphs themselves: (i) the number of birds under observation, which in the case of native fowls was for a period too small for conclusions to be drawn with certainty, (ii) the natural decline in egg production which follows the pullet flush. While it would probably be unwise to attempt to draw detailed conclusions from any of the graphs over the whole period which they cover, the broad statement may be made that the wet seasons appear to have a depressing effect, which may in the case of pure and half-bred Rhode Island Reds be severe, on the general condition and fecundity of fowls at Serdang. In support of this statement, attention is drawn to the serious drop in the egg production of pure-bred R.I.R's in March-April 1937, of half-bred birds in October-November 1937, and of all three types in December 1938.

East Africa, India and Thailand.

The author is not aware of any investigations of precisely this nature in other monsoon countries, although some recent work in Tanganyika is of interest(2). There, moulting is not confined to any particular period of the year but is usually prolonged if it occurs during the wet season (January to April). With both R.I.R's and White Leghorns, average egg-yields rise sharply from May to June and then fall slowly from August to November with a further but smaller decline from January onwards, minimum fecundity being reached in April. No mention is made of any falling off in general condition such as is experienced at Serdang. The observed facts are attributed in Tanganyika to seasonal variations in the amount of sunshine (which should not be confused with length of day). Rainfall records there are not given, but it is only to be expected that the number of hours of sunshine declines during wet weather, except possibly where precipitation occurs in short, heavy bursts rather than steadily over a period. As regards hatching seasons, chicks hatched between June and October in Tanganyika are stated to make better growth than those hatched at other times of the year.

In Malaya, the Kuala Lumpur records for bright sunshine (which probably do not differ materially from what is experienced at Serdang) show that the month of least average sunshine is December (about 140 hours per mensem); September and October are a little better (155 to 150); February is better still (200); while maximum sunshine usually occurs in July (211). It would not appear that the

Date	Pure-Bred Rhode Island Red.								
	Average No. of Layers	No. of Eggs Laid	Average Egg Production	Total No. of Deaths	No. of Deaths Undiagnosed	Undiagnosed Mortality Rate	Ages of Birds in Previous Column.	Average No. of Layers	No. of Eggs Laid
			per cent.			per cent.	months.		
1936 April ...	19	216	37.9	—	—	—	—		
May ...	25	232	29.9	—	—	—	—		
June ...	36	487	45.1	—	—	—	—		
July ...	52	723	44.8	—	—	—	—		
August ...	48	879	59.1	1	1	2.1	7		
September	54	802	49.5	2	1	1.8	7		
October ...	44	808	59.2	—	—	—	—		
November	45	777	57.5	1	1	2.2	7	10	125
December ...	43	676	50.7	2	—	—	—	27	401
1937 January ...	41	528	41.5	4	2	4.9	12, 14	30	517
February ...	36	463	45.9	1	—	—	—	31	424
March ...	35	395	36.4	—	—	—	—	30	462
April ...	39	298	25.5	—	—	—	—	31	305
May ...	66	675	32.9	3	3	4.5	18, 19, 22	30	346
June ...	61	1089	59.5	—	—	—	—	30	299
July ...	65	1094	54.2	1	1	1.5	19½	30	286
August ...	60	1053	56.6	—	—	—	—	30	233
September	65	993	50.9	1	—	—	—	33	244
October ...	71	1258	57.1	—	—	—	—	54	564
November	68	1093	53.5	—	—	—	—	77	740
December ...	68	1074	50.9	—	—	—	—	88	1136
1938 January ...	68	972	46.1	2	—	—	—	91	1080
February ...	61	832	48.7	—	—	—	—	92	915
March ...	61	863	45.6	3	1	1.6	26	91	960
April ...	58	718	41.2	1	—	—	—	91	798
May ...	67	726	34.9	1	—	—	—	89	832
June ...	75	969	43.1	5	3	4.0	14, 15, 18	89	836
July ...	89	1297	47.0	—	—	—	—	88	930
August ...	94	1554	53.3	1	—	—	—	88	774
September	110	1535	49.5	1	—	—	—	86	697
October ...	115	1810	50.8	1	—	—	—	85	638
November	113	1607	47.4	1	1	0.9	10	84	536
December ...	112	571	16.4	9	8	7.1	8, 8, 8, 10, 12, 20, 25, 38	82	523
1939 January ...	102	981	31.0	1	1	0.9	20	81	599
February ...	101	882	31.2	2	1	0.9	11	78	590
March ...	99	923	30.1	2	—	—	—	72	571
April ...	97	951	32.7	2	1	1.0	13	72	513
May ...	88	659	24.2	2	1	1.1	13	71	460
June ...	72	538	24.9	1	—	—	—	58	413
July ...	78	762	31.5	—	—	—	—	49	326
August ...	100	1097	35.4	1	1	1.0	6	48	319
September	108	1467	45.3	3	2	1.8	21, 21	47	322
October ...	109	1436	42.5	2	2	1.9	18, 22	47	306
November	114	1211	35.4	1	1	0.8	23	46	298
December ...	111	1544	44.8	6	4	3.6	7, 7, 8, 10	45	345
1940 January ...	109	1359	40.2	1	1	0.9	11	43	303
February ...	115	1422	42.6	8	2	1.7	23, 26	42	197
March ...	108	1489	44.4	—	—	—	—	42	285
April ...	108	1327	40.9	1	—	—	—	34	236
May ...	108	1113	33.2	1	—	—	—	16	176
June ...	119	946	26.5	—	—	—	—	14	115
July ...	107	1086	32.7	2	2	1.9	18, 27	13	112
August ...	122	1427	37.7	2	1	0.8	12	13	100
September	119	1502	42.1	2	—	—	—	9	95
October ...	115	1646	46.2	1	—	—	—	9	3
November	120	1566	43.5	3	2	1.6	16, 20		
December ...	126	1564	40.0	2	2	1.6	19, 40		

'able I.

nd Mortality Records at Serdang.

Native					Rhode Island Red x Native						
Average Egg Production	Total No. of Deaths	No. of Deaths Undiagnosed	Undiagnosed Mortality Rate	Ages of Birds in Previous Column.	Average No. of Layers	No. of Eggs Laid	Average Egg Production	Total No. of Deaths	No. of Deaths Undiagnosed	Undiagnosed Mortality Rate	Ages of Birds in Previous Column.
per cent.			per cent.	months.			per cent.			per cent.	months.
					25	442	58.9	2	1	4.0	5½
					22	337	49.3	2	—	—	—
					20	264	44.0	2	2	10.0	6½, 11
					18	330	59.1	—	—	—	—
					18	328	58.8	—	—	—	—
					18	347	64.3	—	—	—	—
					18	182	32.6	1	1	5.5	12
41.7	—	—	—	—	17	165	32.3	1	1	5.9	13
47.9	1	1	3.7	5½	16	215	43.3	—	—	—	—
55.6	—	—	—	—	16	215	43.3	—	—	—	—
48.8	1	—	—	—	15	175	41.6	1	—	—	—
49.6	—	—	—	—	14	219	50.5	—	—	—	—
32.8	1	—	—	—	14	163	39.1	1	1	7.1	17
37.2	—	—	—	—	13	186	46.1	—	—	—	—
33.2	—	—	—	—	11	163	49.4	—	—	—	—
30.7	—	—	—	—	11	122	35.8	—	—	—	—
25.1	—	—	—	—	11	136	39.9	—	—	—	—
24.6	—	—	—	—	11	111	33.6	—	—	—	—
33.8	—	—	—	—	11	59	17.3	—	—	—	—
32.0	—	—	—	—	11	61	18.5	—	—	—	—
41.9	1	—	—	—	11	101	29.6	—	—	—	—
38.3	—	—	—	—	11	53	15.5	—	—	—	—
35.5	1	—	—	—	9	109	43.2	—	—	—	—
34.0	—	—	—	—	9	75	26.8	—	—	—	—
29.2	2	1	1.1	22	9	76	28.2	1	—	—	—
30.1	—	—	—	—	8	65	26.2	1	1	12.5	30
31.3	1	—	—	—	5	68	45.3	—	—	—	—
34.4	—	—	—	—	4	51	41.1	—	—	—	—
28.4	2	1	1.1	15	4	43	38.7	—	—	—	—
27.0	1	—	—	—	4	52	43.3	—	—	—	—
24.2	1	1	1.1	28	4	56	45.1	—	—	—	—
21.1	2	2	2.4	28, 28	4	16	13.3	—	—	—	—
20.5	1	1	1.2	19	11	86	25.2	1	1	9.1	38
23.8	2	2	2.4	19, 37	34	450	42.7	—	—	—	—
27.0	2	—	—	—	48	581	43.2	—	—	—	—
25.6	—	—	—	—	50	779	50.3	—	—	—	—
23.7	1	—	—	—	78	986	42.1	—	—	—	—
20.9	—	—	—	—	67	851	40.9	—	—	—	—
23.7	—	—	—	—	67	641	31.8	—	—	—	—
21.4	1	—	—	—	76	1109	47.0	—	—	—	—
21.4	1	—	—	—	84	1230	47.2	—	—	—	—
22.8	—	—	—	—	96	1328	46.1	—	—	—	—
21.0	1	—	—	—	101	1330	42.4	—	—	—	—
21.6	1	1	2.2	29	101	1334	44.0	—	—	—	—
24.7	2	1	2.2	32	101	1384	44.2	1	—	—	—
22.7	1	1	2.3	39	100	1242	40.0	1	1	1.0	11
16.2	—	—	—	—	99	1085	39.1	—	—	—	—
21.9	2	—	—	—	99	1140	37.1	2	—	—	—
23.1	—	—	—	—	97	1023	35.1	—	—	—	—
35.5	1	—	—	—	97	1026	34.1	1	—	—	—
27.4	—	—	—	—	96	872	30.3	—	—	—	—
27.8	—	—	—	—	96	959	32.2	—	—	—	—
24.8	—	—	—	—	96	1019	34.3	—	—	—	—
31.5	—	—	—	—	96	1103	38.3	—	—	—	—
1.1	—	—	—	—	96	1034	34.8	1	—	—	—
					95	930	32.6	—	—	—	—
					95	1044	35.4	3	2	2.1	26, 37

Table II.

Seasonal Loss of Condition in Laying Fowls at Serdang.

Season	Pure-Bred Rhode Island Red.	Native	Rhode Island Red x Native
Wet Season—Late 1936	Egg production down about 30 per cent. Mortality up.	— —	Egg production down about 50 per cent. Mortality slight.
Wet Season—Early 1937	Egg production down about 45 per cent. Mortality up.	No visible effects —	Egg production down about 20 per cent. Mortality slight.
Wet Season—Late 1937	Egg production down about 10 per cent. Mortality up.	Egg production down about 10 per cent. Mortality nil.	Egg production down about 50 per cent. Mortality nil.
Wet Season—Early 1938	Egg production down about 25 per cent. Mortality up.	Egg production down about 10 per cent. Mortality slight.	Egg production down about 30 per cent. Mortality up.
Wet Season—Late 1938	Egg production down about 60 per cent. Mortality serious.	Egg production down about 30 per cent. Mortality slight.	Egg production down about 60 per cent. Mortality up.
Wet Season—Early 1939	Egg production down about 25 per cent. Mortality slight.	Egg production down about 20 per cent. Mortality nil.	Egg production down about 20 per cent. Mortality nil.
Wet Season—Late 1939	Egg production down about 15 per cent. Mortality up.	Egg production normal Mortality slight.	Egg production down about 10 per cent. Mortality slight.
Wet Season—Early 1940	Egg production down about 35 per cent. Mortality nil.	—	Egg production down about 15 per cent. Mortality nil.
Wet Season—Late 1940	Egg production down about 10 per cent. Mortality slight.	—	Egg production down about 5 per cent. Mortality slight.

effects at Serdang are due simply to seasonal variations in the amount of sunshine; if they were, one would expect the greatest loss of condition to occur in or soon after December, and that there should be very little trouble about April (180) — expectations which do not agree with the observed facts.

Correspondence with certain poultry officers in India and Thailand has failed to elicit any information as to what happens there beyond the following broad observations:—

India (United Provinces):— As regards health, the "monsoon" (*i.e.* the S.W. or rain-bringing monsoon) has no appreciable effect on the mortality rate; if anything, the general health of pullets is better then than during the dry season (*i.e.* the N.E. monsoon) when the day temperature may be as much as 15°F. higher then during the wet season. It is, however, generally accepted that, following the break of the S.W. monsoon, moulting is common and egg production is correspondingly low.

Thailand (Haadyai):— The seasons are more or less the reverse of those in India. Such records as are available lead to the conclusion that egg production tends to reach a peak in March-April and a low level in October-November, and that moulting is prevalent during the latter period. Hatchability is said to be satisfactory from January to March but to decline by June to such an extent that hatching is then discontinued for the rest of the year.

Malay Peninsula.

In Malaya, the records of the co-operative egg-marketing societies in Krian usually show a marked decline in turnover towards the end of the year but there is at present insufficient evidence to indicate whether this is directly due to the weather, to a seasonal reduction in the size or number of flocks, to increased activities of higglers, or to a reduction in the amount of protein food which fowls can obtain for themselves in the form of worms and insects. Enquiries at various Departmental poultry stations in the Peninsula have produced the following information concerning pure-bred R.I.R's, but this also must be taken with a certain amount of reserve in that the flocks concerned are almost invariably small:—

Singapore:— No adverse effects can be observed from the 1938 records but egg production dropped about 50 per cent. in October-November 1939 when many birds moulted. Apart from this, there was no apparent loss of condition and only two birds died between October 1939 and February 1940.

Raub (*Pahang*):— There is no evidence that the mortality-rate is higher during wet seasons than in dry ones. Egg production declined considerably during September to November 1937, May to August 1938, January to March 1939 and May 1939. In a flock of pullets which came into lay towards the end of 1938, the pullet flush was uninterrupted in all except two birds which moulted. Native and half-bred pullets which came into lay in September 1939 continued to lay throughout the following wet season.

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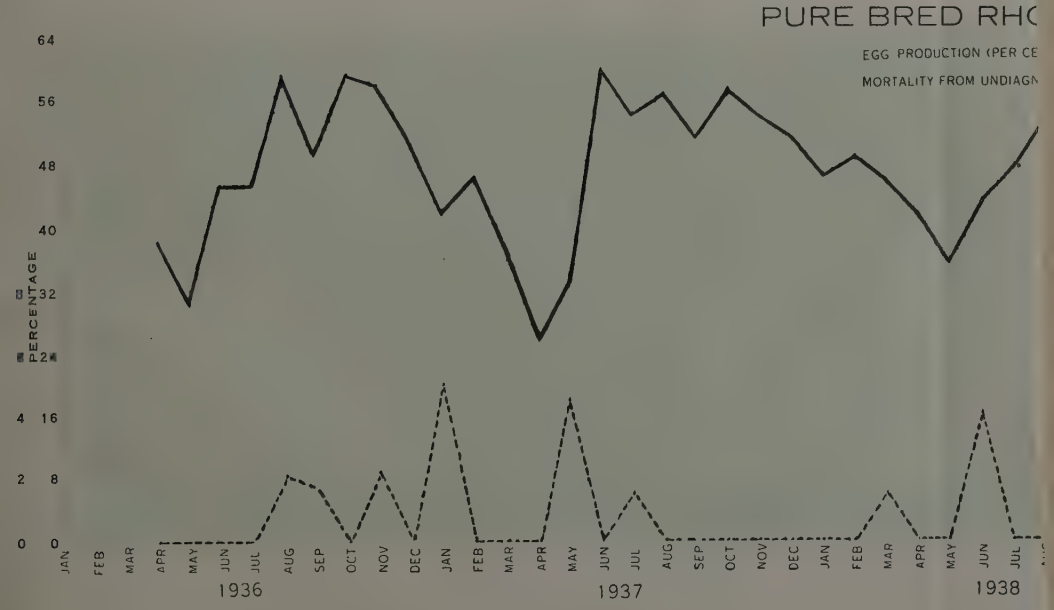
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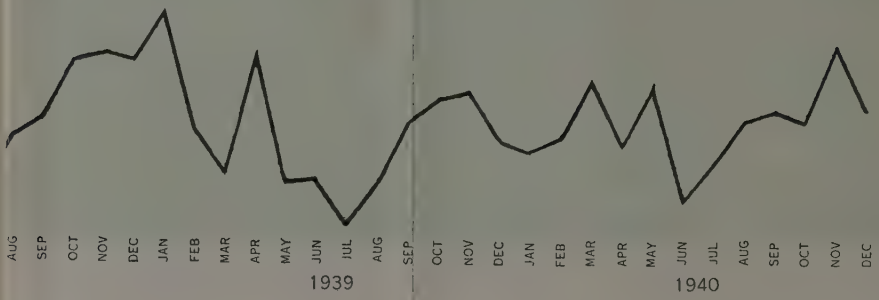
SERDANG (IN INCHES)

FIGURE I

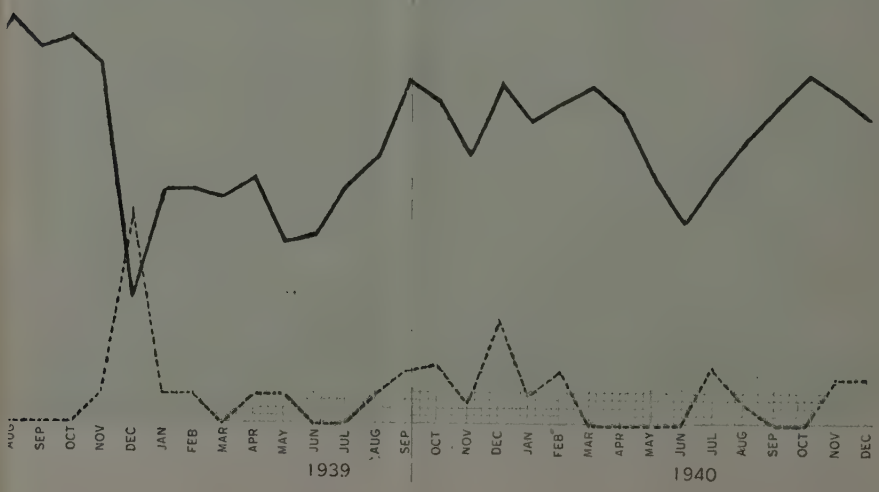


ODE ISLAND RED

NT)

OSED CAUSES (PER CENT)

FIGURE II



Gajah Mati (*Kedah*):— There was a considerable decline in egg production in October-November 1939, accompanied by moulting and a few deaths. Recovery was slow.

Kota Bharu (*Kelantan*):— Mortality records are inadequate, but there is considerable evidence of a seasonal falling off in egg production. Flock A declined in February and November 1935; flock B in November 1935 and in February and August-September 1936; flock C in October 1938 and in March and September 1939; flock D in April and September 1939 and in March 1940. Moulting generally occurs in September-October.

Cameron Highlands (*Pahang*):— Egg production fell by 40 per cent. in October 1939. Moulting usually begins about August and reaches its peak in September. No abnormal mortality has so far been observed.

Kuala Kangsar (*Perak*): Marked declines in egg production occurred during August to December 1936, December 1937 to March 1938, November 1938 and June to November 1939.

Cheras (*Selangor*):— Of some 30 R.I.R's, the majority have experienced a marked drop in production at the same seasons as at Serdang, which is only a few miles away, but the records do not indicate any particular season for moulting.

Johore:— At Tangkak, there was a marked decline in the egg production of R.I.R's in August-September 1939. Production improved in October, when new birds were added to the flock, but declined again in November and the following March. At Jementah, R.I.R's shewed a more or less continuous decline from October 1939 to January 1940, while *kampong* pullets shewed declines in November 1939 and March 1940. At Ayer Hitam, there was a gradual decline with R.I.R's from August 1939 until the end of the year. At no Station was there any abnormal mortality.

Selama (*Perak*):— Sharp declines in the egg production of R.I.R's occurred in October 1938, May 1939 and September-October 1939. During this last period, production in one flock fell from an average of 10 eggs per bird in August to 1 egg per bird in October. It improved to 6 in November and 10 per bird in December.

To summarize, there is considerable support for the belief that the effect observed at Serdang, so far as egg production and moulting are concerned, occurs generally throughout Malaya and to some extent in neighbouring countries. Variation is to be expected as the severity of a wet season differs from place to place and from year to year. As compared with its continental neighbours, Malaya is at a disadvantage in that, over much of the Peninsula, there are two pronounced wet seasons a year; birds may fail to recover completely from the adverse effects of one wet season before the next is upon them.

Newly Imported *versus* Locally Bred Stock.

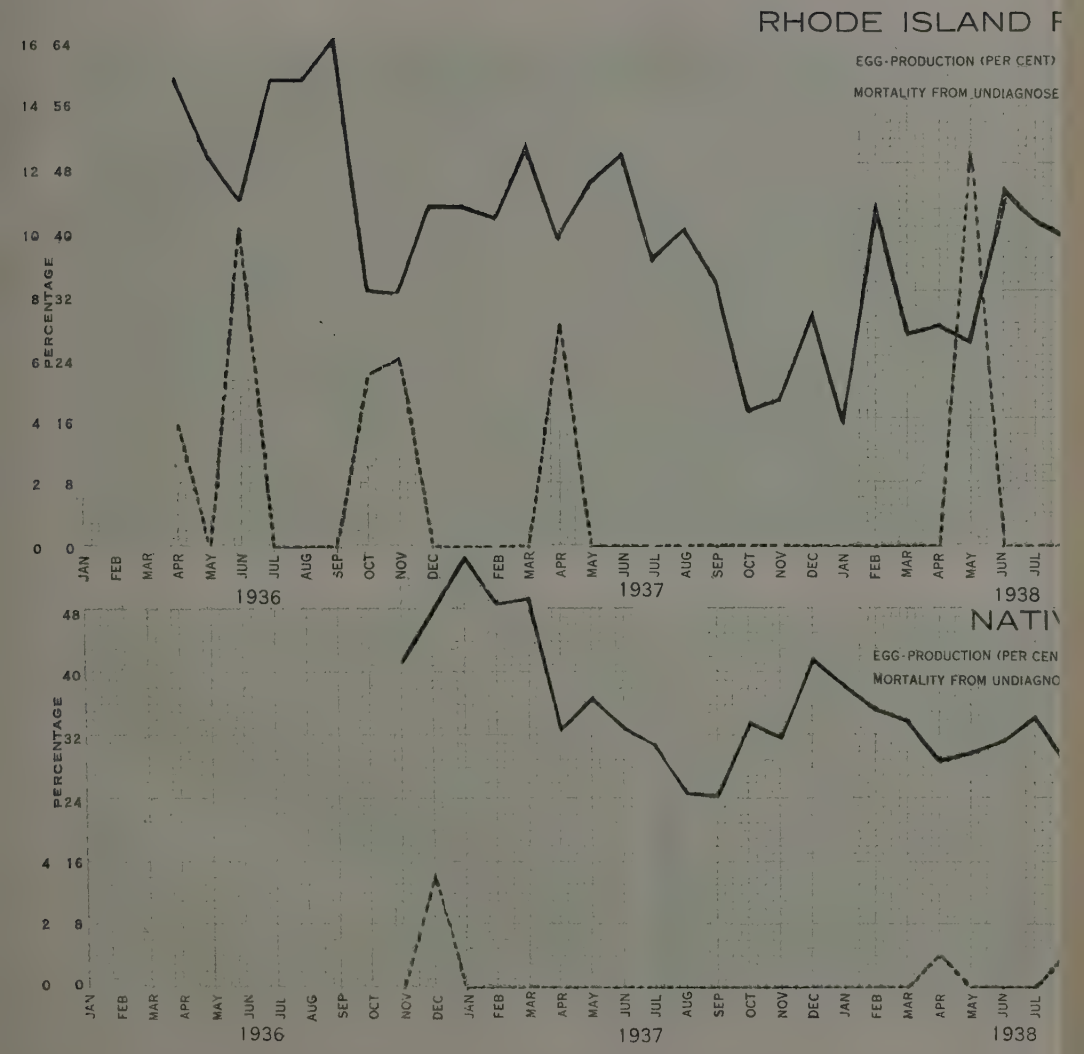
It has been suggested to the author that the observed effects may be merely the result of loss of stamina in locally bred as compared with newly imported pure-bred stock. Evidence as to the behaviour of newly imported R.I.R's is available from only one flock at Serdang on which it would probably be unsafe to base any very definite opinions. The record of the flock, however, is interesting and tends to the belief that newly imported birds may suffer even more than locally bred stock. Thus, of 15 R.I.R. pullets hatched in January and imported from England in good health in June 1936, the majority came into lay in July. Two died soon after arrival (one in August and one in September); five moulted in September-October and again the following March-May with a corresponding decline in egg production; the remaining eight moulted in March-May 1937. In no fewer than six cases egg production failed to return to normal within 4 months of the beginning of the moult; these birds were to all intents and purposes useless for breeding purposes and were disposed of.

Choice of Hatching Seasons.

If the problem were confined to egg production and moulting only, it should be a comparatively straightforward matter to determine whether a solution could be effected by controlling the time of year adopted for hatching. Reference has already been made to the fact that there is an optimum hatching season in temperate climates and it would not at first sight be unreasonable to expect that the control of moulting might similarly be possible in Malaya. Here, however, the solution may actually prove to be more elusive in that, over a great part of the country, there are two wet seasons and possibly two natural moulting seasons a year. There is some little evidence from R.I.R. flocks at Serdang that pullets which come into lay between September and November are affected less than others, but they do not all escape. More observations will be required before any particular season can be accepted as the best for hatching in Malaya.

Increased Mortality.

The problem, however, is not confined to egg production and moulting alone. There is the disturbing fact observed at Serdang that birds tend to lose condition generally and that mortality from so far undiagnosed causes increases. In other words, the birds are not in normal health and the precise nature of the disease is at present obscure. One should avoid attaching too much importance to the mortality aspect of the problem; as already indicated, it is merely the end-point of a progressive decline and seldom occurs in such numbers as to cause alarm. The general impression created by the facts is that R.I.R's and cross-bred birds lack the necessary stamina to resist adverse weather conditions in this country. This impression is supported by a study of the ages at which undiagnosed deaths have occurred (Table I). With pure-bred R.I.R's, this may be at any age from 5 months on-


RHODE ISLAND
EGG-PRODUCTION (PER CENT)
MORTALITY FROM UNDIAGNOSE
PERCENTAGE
16 64
14 56
12 48
10 40
8 32
6 24
4 16
2 8
0 0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL
1936
1937
1938

NATI
EGG-PRODUCTION (PER CEN
MORTALITY FROM UNDIAGNO
PERCENTAGE
48
40
32
24
16
8
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL
1936
1937
1938

K. P. & CO., LTD.

RED X NATIVE

FIGURE III

D CAUSES (PER CENT)

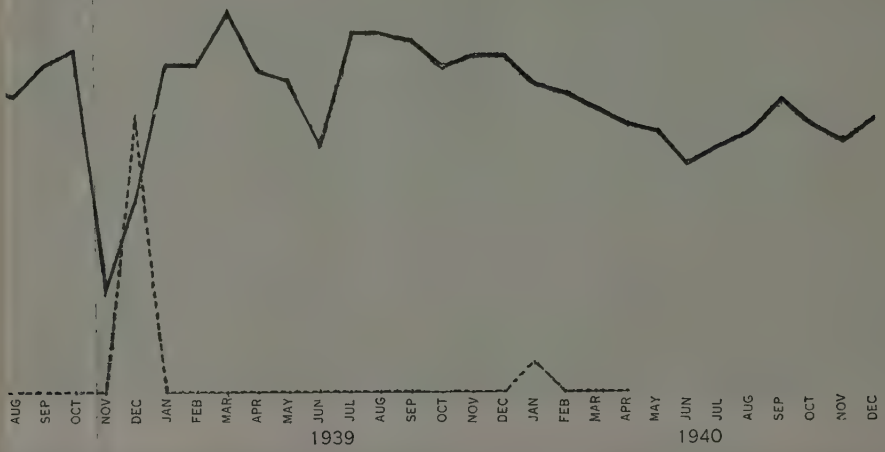


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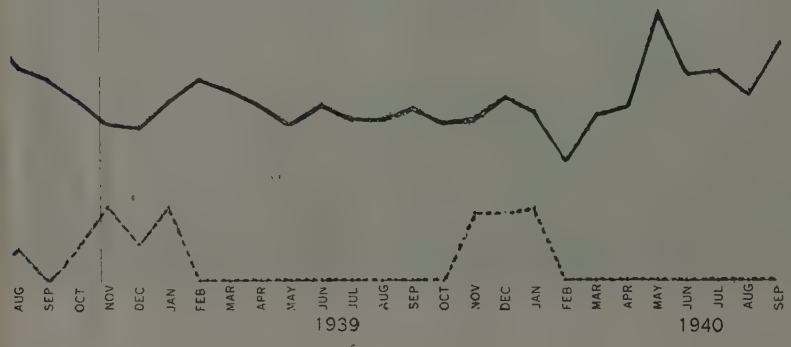
FIGURE IV

SED CAUSES (PER CENT)



wards; with native fowls, no mortality worth mentioning was experienced under 18 months of age; while half-bred fowls were intermediate in behaviour. To attribute the difficulty to lack of stamina, however, may be correct but it is not helpful; it does not tell one precisely what factor or combination of factors in our climate is responsible, and the possibility of devising a remedy must continue to be remote until the precise nature of the problem has been elucidated. It is therefore of interest to consider the lines which further investigations might profitably follow.

A Disease of the Respiratory System?

In the first place, the fact that the trouble occurs during wet weather might not unreasonably lead one to ask whether the birds catch cold or even develop some more serious respiratory infection. Simple colds are often the result of avoidable exposure, *e.g.* through draughty houses, and can usually be dealt with effectively once the cause is traced. But, at Serdang, colds have not been observed; nor has any infection of the respiratory system been detected during *post mortem* examination of the birds involved in these studies. The staff at the School are admittedly not poultry pathologists, however, and the possibility must therefore be admitted that an obscure form of infectious respiratory disease is present but has so far escaped detection. If a broncho-pneumonic infection were eventually found to be responsible, treatment with M & B 693 or similar drugs could be tried and might give as spectacular results with fowls as it already gives with human beings.

Examination of Blood Picture.

The possibility of infection, however, is not confined to diseases of the respiratory system and, if the above tests proved negative, it would be probably worth while to get a complete blood picture of the affected fowls. Thus, the red cell count and estimation of haemoglobin should disclose any abnormality and might conceivably lead to an explanation of and a cure for the observed anaemia. A simple tonic might indeed prove adequate in such case. The utility of blood picture investigations does not cease here, however, for the white cell count — and particularly the differential count in which the proportion of the various kinds of white cells present is determined — should indicate whether certain types of disease are present. Blood counts of domesticated fowls have been carried out by a number of physiologists in various parts of the world but their results to date show such an amazing lack of agreement that anyone working on similar lines in Malaya would probably have to start from the very beginning, first establishing what is normal in different types, ages and possibly even sexes of fowl before proceeding to study the abnormal.

Examination of Heart Beats.

Earlier in this article, attention was drawn to two facts which may be of significance in elucidating the problem under discussion:

(i) that domesticated fowls are easily frightened into a moult;

(ii) that the wet seasons in Malaya are usually accompanied by an increase in the number of thunderstorms.

It may not be entirely fantastic, therefore, to suggest that the effects in Malaya may possibly be due to a nervous condition resulting either from sheer noise or (as seems more likely) from sudden changes in the electrical potential of the atmosphere during these storms. If it is argued that the effects of electricity on animals are usually sudden and dramatic (as, for example, when a person is struck by lightning), whereas the observed effects take the form of a comparatively gradual loss of condition, the author would suggest that electrical effects which are insufficiently powerful to kill outright may conceivably have a gradual but cumulative effect on the nervous system and eventually on the heart and that, in a flock exposed to repeated thunderstorms, some birds might in due course die from heart failure. If this reasoning has any merit at all, investigations with an electrocardiograph might produce useful results. This instrument, appropriately connected by terminals to an animal's body, gives a photographic picture of the heart beats from which one can readily calculate the number of beats per minute, whether the beats are strong or weak, and whether certain abnormalities are present. Here again, it would first be necessary to establish carefully what constitutes "normal" in the domesticated fowl in Malaya before studying the abnormal. A recent trial in Singapore with an apparently healthy fowl gave approximately 330 beats per minute but the average and the range of variation still need to be established from observations on several fowls. Where the rate of heart beats is subnormal, the condition is known as bradycardia and may in human beings be due to various causes such as rheumatic fever, pneumonia, influenza or even certain types of poisoning; while a rate above normal (tachycardia) indicates long-continued paroxysms in which the heart twitches instead of beating with its ordinary rhythm. Quinine, atropine and various other drugs are capable of reducing the rate, while Vitamin B_1 has the same effect in human beings but increases the rate in rats. Medical authorities are, it is understood, agreed that the functioning of the heart is distinctly influenced by the extrinsic nerves, particularly the pneumogastric and sympathetic nerves, and the possibility of a form of polyneuritis (which is well-known in birds) should therefore be taken into consideration.

Investigations should establish in a comparatively short time whether fowls showing the wet season effect have abnormal heart beats and might thus lead to some form of control by means of drugs or by adjusting the diet.

Summary and Conclusions.

(i) Fowls are sensitive to their environment, in which climate plays an important part.

(ii) The effect of adverse climatic conditions can sometimes be controlled by artificial means.

(iii) A wet season effect on domesticated fowls at Serdang is described; it is characterized mainly by decreased fecundity, increased incidence of the moult, and a rise in mortality from at present undiagnosed causes.

(iv) It is unsatisfactory to dismiss the problem by attributing it merely to "lack of stamina." Various conjectures are therefore made as to possible factors connected with the weather which may be the prime cause of this loss of condition.

(v) It is suggested that the most promising lines which further investigations should follow are:—

(a) Trials to ascertain more definitely whether there is an optimum hatching season in Malaya.

(b) Detailed pathological examination of affected birds to determine whether an infectious disease of the broncho-pneumonic type is present.

(c) Examination of the blood picture and heart beats to ascertain more precisely the nature of the condition and whether preventive or curative treatment is possible by means of drugs or by adjusting the diet.

Acknowledgments.

The author is indebted to Mr. Choo Kok Leong for keeping and extracting the extensive records on which this article is based, and to those Field Officers of the Department of Agriculture who have examined and reported on their own records.

References.

(1) The Rainfall of Malaya, by C. D. Stewart. *Malayan Agricultural Journal*, Vol. XVIII, No. 11.

(2) Some Observations on Poultry, by M. H. French. *East African Agricultural Journal*, Vol. VI, No. 2.

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THE VALUE OF FISH REFUSE AS A FOOD FOR PIGS

By

C. W. S. Hartley,

Agricultural Officer, Province Wellesley and Penang.

Introductory.

In a recent feeding trial in Penang to compare a balanced ration with a local Chinese ration(1), it was observed that the local ration contained a quantity of fresh fish refuse (*"ikan busok"*) and it was suggested that if this fish were introduced into a balanced ration it would be very useful in supplying minerals and proteins at a cheap rate.

Rations were therefore devised in which fish refuse replaced all the additional minerals used in previous balanced rations, and supplied the bulk of the protein required. Two trials were carried out, one in which the fresh form of *"ikan busok"* was used and the other in which both the fresh and salted forms were tested.

"Ikan busok" consists of all the small, unsuitable and damaged fish which remain after the fish suitable for human consumption has been removed from the catch. It is sold either fresh, in which form it must be bought and used at once, or dried and salted. In the first trial the use of salted fish was not considered. firstly because the price was 3 to 4 cents a kati* against 1 cent for fresh fish, and secondly because an excess of salt in a ration is harmful to the pigs. Immediately before the first trial started, however, the price of fresh fish refuse in Penang rose to 3 to 4 cents a kati and has remained at this level ever since, only occasionally going down to as low as 2 cents a kati.

The price of salted fish did not rise appreciably and, in view of the fact that the average moisture content of salted fish is 50.5 per cent. compared with 72.0 per cent. for fresh fish, it was clear that the salted product would be more economical to use, assuming its feeding qualities to remain unaffected after removal of the excess salt by soaking the material in water†. Experiments showed that over 80 per cent. of the original salt could be removed by soaking for 2 hours.

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* Kati = 1⅓ lbs.

† Analyses of soaked *"ikan busok"* and of the aqueous extract obtained on soaking, which have been carried out since the compilation of this paper, have shown the removal of the salt to be accompanied by a loss of nitrogen. This loss is due to protein decomposition which takes place before it can be checked by diffusion of salt and desiccation. Nitrogen is lost in the form of amines, amides, amino-acids and peptone, and as protein itself, but the greater part of the loss is in the form of amino-acids and peptone.

Experiments showed that with the 2 hours soaking as used in the trials to be described the total loss of nitrogen varied from 10 to 15 per cent., but if the fish were cut up and soaked for a longer period, up to 35 per cent. of the original nitrogen present might be lost. It is not considered that a loss of 10 to 15 per cent. will invalidate to any extent the conclusions reached in the present trials. Further investigational work on the above lines is planned.

Table I shows figures for the average composition of fresh and dried *"ikan busok."*

Table I.

Results of Analysis of *"Ikan Busok"*.

Form of *"Ikan Busok"*	Dry Matter	Protein	Fat	Ash	Chlorides calculated as NaCl	Digestible Nutrients	
						Protein	Fat
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Fresh ...	28.0	14.2	1.5	10.7	1.4	12.7	1.2
Dried ...	49.5	25.4	2.7	21.7	18.5	22.8	2.2

Details of Rations.

The rations used were tested against balanced rations previously found to be satisfactory at Serdang(2) and in Penang(1), the only alteration being the substitution, weight for weight, of groundnut cake for soya bean cake. In the second trial the quantity of groundnut cake was reduced by 1 lb. per 1,000 lbs. live-weight per day, owing to its higher dry matter and protein content. These rations are shown with costs in Table II and are referred to as rations A.

As already mentioned, in the rations containing fish refuse, the quantity of fish included was sufficient to provide all the minerals and the bulk of the proteins in the ration. As far as possible the other ingredients in the ration were unaltered so as to give a true comparison between fish on the one hand and groundnut cake, minerals and red palm oil on the other. The fish rations are set out, with costs, in Table III and are referred to as rations X (fresh) and X (dried). It will be noted that the protein content of these rations, although within Kellner's standards, is below that of the A rations.

Rations A_1 and X_1 were made up as far as possible to Kellner's standards for animals averaging 44 lbs. live-weight, and rations A_2 and X_2 for animals averaging 88 lbs. live-weight.

Table II.

Analysis and Costs of Rations A.

(lbs. per 1000 lbs. live-weight per day).

Ration A_1

Food	Quantity	Dry Matter	Digestible Nutrients			Average Cost per picul during Experiments	Cost per day per 1000 lbs. live-weight
			Protein	Fat	Nitrogen-free Extract		
	lbs.	lbs.	lbs.	lbs.	lbs.	$	$
Broken rice ...	26	23.03	1.66	0.08	20.77	3.45	0.67
Rice polishings	3	2.70	0.21	0.34	1.22	2.10	0.05
Coconut cake (double pressed)	5	4.41	0.64	0.43	2.34	1.74	0.07
Groundnut cake ..	10	9.22	4.07	0.82	2.00	3.64	0.27
Guinea grass ...	10	2.50	0.09	—	0.79	—	—
Banana stems ...	20	1.02	0.02	0.02	0.60	0.06	0.01
Red palm oil ...	1	1.00	—	1.00	—	20.00	0.15
Minerals ...	0.5	0.50	—	—	—	6.00	0.02
Total ...	75.5	44.38	6.69	2.69	27.72		1.24
Kellner's Standards ...		44.00	5.4 — 6.6	1.04	28 — 29		

Ration A_2

Tapioca roots ...	50	17.50	0.50	—	15.40	0.55	0.21
Rice polishings	6	5.40	0.42	0.68	2.44	2.10	0.10
Coconut cake (double pressed)	6	5.29	0.77	0.51	2.84	1.74	0.08
Groundnut cake ..	8	7.38	3.26	0.66	1.60	3.64	0.22
Red palm oil ...	1	1.00	—	1.00	—	20.00	0.15
Minerals ...	0.5	0.50	—	—	—	6.00	0.02
Total ...	71.5	37.07	4.95	2.85	22.28		0.78
Kellner's Standards ...		36.00	4.0 — 5.6	0.9	25.5 — 26.5		

Table III.

Analysis and Costs of Rations X (fresh) and X (dried).

(lbs. per 1000 lbs. live-weight per day.)

Ration X_1 (fresh).

Food	Quantity	Dry Matter	Digestible Nutrients			Average Cost per picul during Experiments	Cost per day per 1000 lbs. live-weight
			Protein	Fat	Nitrogen-free Extract		
	lbs.	lbs.	lbs.	lbs.	lbs.	$	$
Broken rice ...	26	23.03	1.66	0.08	20.77	3.45	0.67
Rice polishings	6	5.40	0.42	0.68	2.44	2.10	0.10
Banana stems ...	20	1.02	0.02	0.02	0.60	—	0.01
Coconut cake (double pressed)	11	9.70	1.41	0.94	4.68	1.74	0.14
Fish (fresh) ...	18	5.04	2.29	0.22	—	3.23	0.44 (0.14)*
Total ...	81	44.19	5.80	1.94	28.49		1.36 (1.06)
Kellner's Standards ...		44.0	5.4 — 6.6	1.0	28 — 29		

Ration X_2 (fresh).

Tapioca roots ...	50	17.50	0.50	—	15.40	0.55	0.21
Rice polishings	6	5.40	0.42	0.68	2.44	2.10	0.10
Coconut cake (double pressed)	11	9.70	1.41	0.94	4.68	1.74	0.14
Fish (fresh) ...	18	5.04	2.29	0.22	—	3.23	0.44 (0.14)*
Total ...	85	37.64	4.62	1.84	22.52		0.89 (0.59)
Kellner's Standards ...		36.0	4.0 — 5.6	0.9	25.5 — 26.5		

* The figures in brackets indicate the cost of the fresh fish rations if the price of fresh fish had been 1 cent per kati during the experiment.

Table III. *(Cond.)*

Ration X_1 (dried).

Food	Quantity	Dry Matter	Digestible Nutrients			Average Cost per picul during Experiments	Cost per day per 1000 lbs. live-weight
			Protein	Fat	Nitrogen-free Extract		
	lbs.	lbs.	lbs.	lbs.	lbs.	$	$
Broken rice ...	26	23.03	1.66	0.08	20.77	3.45	0.67
Rice polishings	6	5.40	0.42	0.68	2.44	2.10	0.10
Banana stems ...	20	1.02	0.02	0.02	0.60	—	0.01
Coconut cake (double pressed)	11	9.70	1.41	0.94	4.68	1.74	0.14
Fish (dried) ...	10	4.95	2.28	0.22	—	3.73	0.28
Total ...	73	44.10	5.79	1.94	28.49		1.20
Kellner's Standards ...		44.0	5.4 — 6.6	1.0	28 — 29		

Ration X_2 (dried).

Tapioca roots ...	50	17.50	0.50	—	15.40	0.55	0.21
Rice polishings	6	5.40	0.42	0.68	2.44	2.10	0.10
Coconut cake (double pressed)	11	9.70	1.41	0.94	4.68	1.74	0.14
Fish (dried) ...	10	4.95	2.28	0.22	—	3.73	0.28
Total ...	77	37.55	4.61	1.84	22.52		0.73
Kellner's Standards ...		36.0	4.0 — 5.6	0.9	25.5 — 26.5		

The Trials.

The first trial was started on 3rd October 1939, when 8 weaner half-bred pigs from one litter were divided into two lots of the same total weight and fed on rations A and rations X (fresh) respectively. Each lot contained 2 males and 2 females. The pigs were fed for 6 months by which time they had reached over 160 lbs. live-weight. The results are set out in Table IV.

The second trial was started in March 1940, when a litter of 12 half-breds was divided into three groups of 4 pigs of almost equal total weight and fed on rations A, X (fresh) and X (dried). Group A contained 4 males and groups X (fresh) and X (dried) 3 males and 1 female each. The pigs were fed for 5 months by which time they had reached 1 picul* live-weight, which is the normal selling weight for pigs in Penang. The results are given in Table V.

Table IV.

Individual Weights of Pigs and Live-Weight Gains in the First Trial.

Ration A.

Pig	Weaning 3rd Oct.	3rd Nov.	3rd Dec.	3rd Jan.	3rd Feb.	3rd Mar.	3rd Apr.	Live-weight Gains.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1.	14.0	31.0	48.0	64.0	99.0	135.0	182.0	168.0
2.	16.0	32.0	46.0	66.0	92.0	132.0	155.0	139.0
3.	16.0	23.0	45.0	59.0	91.0	123.0	164.0	148.0
4.	16.0	26.0	37.0	42.0	61.0	95.0	141.0	125.0
Mean	15.5	28.0	44.0	57.8	85.8	121.3	160.5	145.0

Ration X (fresh).

	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
5.	17.0	32.0	55.0	78.5	114.0	147.0	180.0	163.0
6.	14.5	27.5	51.0	75.0	110.0	145.0	184.0	169.5
7.	16.5	31.5	52.0	69.0	96.0	133.0	161.0	144.5
8.	14.0	23.0	38.0	57.0	81.0	108.0	134.5	120.5
Mean	15.5	28.5	49.0	69.9	100.3	133.3	164.8	149.4

* picul = 133⅓ lbs.

Table V.

Individual Weights of Pigs and Live-Weight Gains in the Second Trial.

Ration A.

Pig	Weaning 26th Mar.	26th Apr.	26th May	26th June	26th July	26th Aug.	Live-weight Gains.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1. ...	17.0	30.5	55.0	77.0	100.0	142.0	125.0
2. ...	12.5	22.5	33.0	53.5	68.0	102.0	89.5
3. ...	14.0	25.5	44.0	72.0	102.0	143.0	129.0
4. ...	15.5	26.5	49.0	69.5	94.0	130.0	114.5
Mean ...	14.8	26.2	45.3	68.0	91.0	129.3	114.5

Ration X (fresh).

	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1. ...	14.0	26.5	47.0	70.5	95.0	134.0	120.0
2. ...	12.0	24.5	44.0	58.5	82.0	118.0	106.0
3. ...	20.0	34.5	58.0	79.5	107.0	143.0	123.0
4. ...	12.5	28.0	50.0	74.0	98.0	133.0	120.5
Mean ...	14.6	28.4	49.8	70.6	95.5	132.0	117.4

Ration X (dried).

	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1. ...	16.0	29.5	51.0	72.5	98.0	131.0	115.0
2. ...	13.0	26.5	40.0	67.0	90.0	121.0	108.0
3. ...	14.5	30.0	52.0	77.0	102.0	140.0	125.5
4. ...	15.0	30.5	50.0	67.0	93.0	134.0	119.0
Mean ...	14.6	29.1	48.3	70.9	95.8	131.5	116.9

It will be seen that in both experiments the live-weight gains made by the pigs fed on fish refuse were very slightly greater than the live-weight gains made by the pigs on balanced ration A. These differences are not, however, significant. There was no difference, in the second experiment, between the live-weight gains made by pigs on fresh and on dried fish, showing that the drying and salting of the fish in no way affects its feeding value for pigs or its palatability, provided that the greater part of the salt is removed by soaking in water as described.

Table VI summarizes the results of both experiments

Table VI.
Results of Trials.

	Trial I		Trial II		
	Ration A	Ration X (fresh)	Ration A	Ration X (fresh)	Ration X (dried)
	lbs.	lbs.	lbs.	lbs.	lbs.
Average weight at weaning ...	15.5	15.5	14.8	14.6	14.6
„ „ „ 7 months ...	121.3	133.3	129.3	132.0	131.5
„ „ „ 8 „ ...	160.5	164.8	—	—	—
Live-weight gain in 7 „ ...	105.8	117.8	114.5	117.4	116.9
„ „ „ 8 „ ...	145.0	149.3	—	—	—
	$	$	$	$	$
Actual cost of food per pig ...	12.84	15.06 (9.86)*	9.47	10.16 (7.17)*	8.62
	cents	cents	cents	cents	cents
Actual cost per lb. live-weight gain ...	8.86	10.09 (6.60)*	8.27	8.65 (6.11)*	7.37

* The figures in brackets indicate the cost of the fresh fish rations if the price of fresh fish had been 1 cent per kati during the experiment.

The average carcase percentage of the pigs fed in the first trial, where an average live-weight of 160 lbs. was reached, was 79.4 per cent. Judged by English standards this is rather too high and shows an excess of fat. In the second trial, where the pigs were fed to only 133 lbs. live-weight, the average carcase percentage was 76.5 per cent. There were no differences in the carcase percentages between the rations.

Discussion.

The feeding trials described have shown that fish refuse in both its fresh and dried forms can replace groundnut cake and minerals in balanced rations without reducing the live-weight gains of the pigs. Very cheap rations containing fresh fish can be made up if the price of this fish is below 2 cents a kati. Above this price it is more economical to use dried fish. The rise in the price of fresh fish in Penang

is probably due to increased demand, for in other coastal districts, notably Province Wellesley and Bagan Datoh in Perak, fresh fish can still be obtained for 1 to 1½ cents a kati.

The dried fish rations, with prices obtaining in Penang, are a little cheaper than the balanced rations A containing groundnut cake, red palm oil and minerals. It is doubtful if the inclusion of red palm oil in the A rations is necessary, and if this ingredient were excluded, these rations would actually be a little cheaper than the dried fish rations. To the Chinese pig rearer, however, the disadvantage of the A rations is that three different minerals have to be bought and mixed. It is probable, therefore, that where a cheap supply of fresh *"ikan busok"* is not available, a ration containing both groundnut cake and dried fish would prove the cheapest and most convenient ration for the Chinese rearer.

When feeding fish or fish products to pigs the question of taint has always to be considered. In England where fish meal is employed it is usually recommended that this food should be excluded from the ration for two weeks before slaughter, although many tests have shown that it is only meal containing herring that is likely to cause a taint(3). As Chinese rearers habitually feed small quantities of fish refuse up to the time of slaughter, it was decided to feed the fish refuse throughout these trials and give portions of meat from each lot of pigs to representative Chinese consumers for tasting. Meat from all treatments was eaten by six Chinese after the first trial and eight Chinese after the second trial. No fishy taint was noticed by any of the tasters and no differences were noted between treatments. The tasters were almost unanimous in their comments. The meat was pronounced to be of very high quality as regards taste and tenderness, and, compared with average local pork, it was said to be much more tender, to contain a lower proportion of fat, and to be considerably paler in colour. This latter point was said by the butchers to be a disadvantage, as the public were accustomed to redder meat, but by those who tasted and knew the value of the meat it was not considered a disadvantage.

Acknowledgments.

Acknowledgment is made to Mr. Tan Ah King, Agricultural Assistant, who supervised the trials and to Mr. Gunn Lay Teik, Chemist, for carrying out several analyses of fish refuse.

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2. Marsh, T. D. and Kanagaratnam, N. Pig Husbandry and Preliminary Feeding Trials at the Stock Farm, Serdang. *Malayan Agricultural Journal*, Vol. XXVI, No. 3, March 1938, page 94.
3. Woodman, H. E. Fish Meal as a Food for Live Stock. Ministry of Agriculture and Fisheries. Bulletin 63, 1933.

Received for publication 29th January, 1941.

A NOTE ON THE DISTRIBUTION OF VITAMIN B_1 (THIAMIN) IN THE RICE GRAIN.

It has long been recognized that a negative correlation exists between the amount of milling to which rice is subjected and its content of thiamin or vitamin B_1. The extent to which a rice grain has been milled may be determined by immersing it in an aqueous solution of iodine. That this is so depends on the following facts. The surface of the grain is bounded by two tissues, the pericarp and testa. Within these lie the endosperm, which forms the greater part of the grain, and the embryo or germ. The surface of the endosperm is bounded by a tissue known as the aleurone layer, which lies immediately beneath the testa and extends over the whole of the grain with the exception of the embryo. These three bounding tissues (pericarp, testa and aleurone layer), which are known collectively as the 'pericarp', stain a yellow-brown colour when brought into contact with a solution of iodine. Within this 'pericarp' lie the starch-bearing cells of the endosperm. The embryo, which is also a brown-staining structure, lies to one side of the basal end of the grain, and, it is important to note, occupies not more than 2 per cent. of the total surface area of the grain. Now when a grain is milled, varying proportions of the 'pericarp' (depending on the extent of the milling), and often the entire embryo, are removed, exposing an equivalent area of the starch-bearing cells of the endosperm. If the milled grain is then immersed in a solution of iodine, the exposed starch-bearing cells take on a blue-black colouration and at once become sharply differentiated from any brown-staining 'pericarp' that may still be present. By direct inspection, or by some less subjective means, it thus becomes possible to arrive at a figure which represents the percentage area of 'pericarp' remaining. Such a figure is an index of the extent to which the grain has been milled.

On the basis of an assumption that the thiamin content of a rice grain is mainly present in the aleurone layer and embryo, Vedder and Feliciano[1] suggested that from the area of brown-staining tissue, or 'pericarp', remaining on a grain after milling a rough measure of the thiamin status of the grain might be deduced. But a little consideration will show that this single assumption is not enough. For such a deduction to be valid it is also necessary to assume that the thiamin is uniformly distributed throughout the aleurone layer and the embryo. It has already been mentioned that the embryo occupies not more than 2 per cent. of the surface area of a grain. Therefore, for the second assumption to hold good the thiamin content of the embryo should not much exceed 2 per cent. of that of the whole grain.

In the light of information regarding the distribution of thiamin in certain other cereal grains, it seemed highly improbable that the thiamin content of the embryo of the rice grain could be as low as 2 per cent. of the total; but the position was obscure as no critical work had been done on rice. The need for clarification of the situation being evident, arrangements were made to investigate the question

in collaboration with the Institute for Medical Research. Embryos were dissected from 50 gm. of husked (unpolished) rice, and these embryos, together with the residue of the 50 gm. from which they had been dissected, and an additional quantity of whole grain were handed to Dr. I. A. Simpson, Chemist, I.M.R., for analysis. Employing the thiochrome method for the assay of the vitamin, Dr. Simpson has obtained results which indicate that about 50 per cent. of the thiamin content of a grain is concentrated in the embryo. Quite apart from the fact that these results show the iodine method to be entirely invalid, their importance becomes even more apparent when it is remembered how easily embryos are removed in milling. It is because of these far-reaching implications that it has been considered desirable to publish this preliminary note on work that is still in progress.

Reference.

1. Vedder, E. B. and Feliciano, R. T. *Phil. Journ. Sci.* 35: 351-387. 1928.

R. A. A.

Review.

The Uses and Control of Natural Undergrowth on Rubber Estates.

Planting Manual No. 6. 2nd Edition. Rubber Research Institute of Malaya. 37 pp. 11 plates. Appendix of 69 pages line drawings. 1940. Price $2.50.

A few years ago there was much discussion in local planting circles concerning the merits and demerits of the so-called "forestry system" whereby advantage is taken of natural growth of indigenous plants to form ground cover. There was, in fact, much confusion of thought at that time on the subject, some considering that the new system was a cure for all the problems of the planter, while at the other extreme the system was looked upon as "a scientific explanation of neglect of weed control". In the first edition of this Manual Dr. W. B. Haines presented planters with a fairly clean-cut and workable "forestry system".

It is pointed out that the use of the term "forestry" in connexion with natural undergrowth is liable to be much abused. For instance, a cover of natural undergrowth itself is sometimes referred to by the name "forestry". The term should, however, be confined to a system, *i.e.*, the forestry system of soil management involving the use of indigenous plants as ground cover, and it is with this definition that the Institute accepts the term.

In the course of the past six years the Institute has re-examined this question of natural covers on carefully laid out experiments at their Experiment Station at Sungei Buloh and by observations on estates in different parts of Malaya. As a result the public is given a second edition of Dr. Haines' work, prepared by the present staff of the Institute, in which the text has in many places been revised, certain omissions made, and in other places amplified to bring it up to date with present knowledge. The Foreword explains that the present Manual "is devoted primarily to a consideration of the best methods for the establishment, maintenance and control of indigenous cover plants. The various specific functions that covers fulfil are discussed only so far as is necessary adequately to explain the practical considerations involved. Much of the discussion of these specific functions, which formed part of the edition of this Manual, is equally applicable to introduced leguminous covers". Such part of that discussion is therefore omitted from the present edition and reserved for a separate publication at a later date.

One does not belittle Dr. Haines' original publication in stating that the present edition is necessarily more comprehensive than its predecessor. Dr. Haines' work stands, but it is extended in the light of experience from a 23 page to a 37 page publication, while the full-page line drawings of cover plants have been increased from 31 to 69.

The arrangement of the present edition deserves special mention. Whereas the first edition was little more than a paper-covered pamphlet with a collection of loose pages of illustrations, the present edition is cloth bound and so arranged that the reading matter and the illustrations in an appendix may be consulted to-

gether. The Appendix includes an index of botanical names of plants, with classification, and useful indices of English, Malay and Tamil names of plants, besides 69 full-page line drawings of plants. This arrangement and the increase in size of the book have necessitated an advance in publishing price from $1 to $2.50. The reader is, however, given good value. A knowledge of the subject matter of this book is essential in present-day rubber planting, and this compact volume will therefore repay the planter in presenting a comprehensive treatise on this important subject.

D. H. G.

VEGETABLE GARDENING IN MALAYA.

The Department of Agriculture has in hand the publication of a book on Vegetable Gardening in Malaya by Messrs. J. N. Milsum and D. H. Grist, which will replace the previous Departmental publication "The Cultivation of Vegetables in Malaya" by Messrs. B. Bunting and J. N. Milsum, which has been out of print for some time.

"Vegetable Gardening in Malaya" is planned on a more ambitious scale than the preceding work and will include a large number of illustrations of vegetables as found in the local markets.

It is anticipated that the new book will appear within the next two months and will be sold at $2 post free. In the meantime excerpts from it are appearing every Thursday in *The Straits Times*. The first of these excerpts was published on 23rd January 1941 and it is anticipated that there will be about fifteen in all. Copies of excerpts may be purchased from the publishers of that paper.

Notes and Comments.

INCREASED FOOD PRODUCTION IN MALAYA.

From the outbreak of war, prapaganda has been directed to the increase of food crops in Malaya to reduce the quantity of imports. How far such efforts have succeeded is evinced by a comparison of the statistics of areas planted at the end of 1940 with those at the end of 1939.

Rice remains the most important food crop. The area in 1940 increased from 753,240 acres to 793,340 acres. The 1940 season was, however, unfavourable in many parts of the country, in consequence of which the crop decreased by 1.8 per cent. Present indications are that the rice crop in the coming season will be greater than last year.

Any increase in area under fruits, other than bananas, would be unlikely to affect the present or immediate future food supplies in Malaya. Bananas, however, are an important and quick-growing food crop, and it is satisfactory to note, therefore, that the area has increased by 31 per cent.

Of vegetables, root crops increased by 30 per cent., market gardens and other vegetable areas by 16 per cent., and other foodstuffs, such as sago, sugar-cane, groundnuts and maize, increased by 40 per cent.

The total increase of all foodstuff areas, other than rice, but including bananas, was 36,500 acres, or 28 per cent.

The above are conservative figures, for it is known that areas under foodstuffs on estates have increased, while vegetable gardens attached to private houses are more numerous. There is, however, no complete record of such areas.

SCHOOL GARDENING.

In 1921, by agreement between the Departments of Agriculture and Education, a system of control of school gardens was inaugurated whereby officers of the former Department visited school gardens and offered advice on the conduct of the work.

At the end of 1922 the Sultan Idris Training College for the training of vernacular teachers was opened at Tanjong Malim, when school gardening was included in the curriculum and taught by an officer with an agricultural training, thus following the practice obtaining previously at the smaller school at Matang which the Tanjong Malim College replaced. Teachers for this training school have become masters in vernacular schools throughout the country, and have been given an opportunity to apply the methods advocated at the training school.

For the past ten years there has been close co-operation between the Agricultural and Education Services in the establishment and maintenance of school gardens. Standardized instructions were drawn up and issued for the guidance of both the teachers and those subordinate officers of the Agricultural Service whose duties include the supervision of school gardens. The Field Branch also collaborates with the Education Service in awarding prizes in the annual School Garden Competitions.

The object of teaching gardening in schools is not only to inculcate a rudimentary knowledge of the system of growing vegetables and other plants, but to develop the powers of observation, and encourage tidiness, and to emphasize the dignity of labour — that there is no indignity in wielding a farm implement, and in practising rural husbandry. It is hoped that the teaching of gardening in schools may give the pupils a real liking for agriculture and in this way help in some measure to maintain the "back to the land" movement, leading not only to the desirable increase of food production in Malaya, but to the happiness and well-being of the rural population.

It is generally accepted that school gardening is an important subject in the curriculum for schools in rural areas. In Malaya, most vernacular schools have a garden and the crops grown therein have been, for the most part, those commonly grown in the market gardens of the country. The fact remains, however, that, up to the present, this has not led to an extension of the cultivation of these crops on the holdings of Malay peasants. The Malay ordinarily grows a variety of plants which he uses as vegetables and condiments with his rice and he also collects the leaves and stems of many indigenous plants for the same purpose. It is not known whether these Malay vegetables are eaten in sufficient quantity to enable them to replace the better-known market-garden vegetables as a portion of the diet of the ordinary Malay peasant. Investigations are in hand, however, and a large numbers of plants used by Malays are listed in a recent publication of the Department of Agriculture,* with an analysis of each which indicates its worth as an article of diet. One advantage these vegetables have is that they can be more easily grown on a Malay holding — which is for the most part shaded by fruit and other trees — than can most of the ordinary market-garden vegetables.

It may be desirable, therefore, in the light of present knowledge, to reconsider the list of crops to be grown in Malay vernacular schools, so that the village lad may make a more practical use in after life of the knowledge gained at school on the cultivation of vegetables suitable for cultivation in Malay holdings.

SYNTHETIC RUBBER.

That synthetic rubber cannot "be universally substituted for the natural product," was reported to the Society of Automotive Engineers by L. B. Sebrell and R. P. Dinsmore, of the Goodyear Tire and Rubber Company. It is, they stated, "a material having special properties which, when properly handled, will give improved results as compared with rubber. On the other hand, we should look upon it as a material whose development and perfection will liberate us from the threat of embargo of natural rubber during the time of national emergency and as a guarantee that the price of natural product will never again reach the peaks which have characterized it in the past."

* Malay Leaf and Other Vegetables and their Analyses by J. L. Rosedale and J. N. Milsum. Special Bulletin, General Series No. 31. Price 50 cents (Malayan currency).

Although synthetic rubbers possess elasticity and resilience, they differ considerably in molecular makeup, and it ought not to be expected that they will process just the same way as natural rubber. This study is limited to synthetic rubbers capable of vulcanization.

By far the most serious aspect of the successful use of these rubbers is their difficult processability. For severe service in tire treads, certain synthetic rubbers were recommended by the authors, who added that they cannot, at present, be expected to equal natural rubber in rebound. Synthetic rubber cannot be substituted for natural rubber on a quantitative basis or on an equal cost basis without examining carefully the physical properties which are to result from such a procedure. There are also encountered various difficulties in substituting synthetic rubber for natural rubber. Typical compounding results for several vulcanizable synthetic rubbers in two different formulas were given, as were tabular data on dynamic tests. — *Science,* 24th January, 1941.

Departmental.

DEPARTMENTAL NOTES.

Appointment.

Dr. T. A. Buckley, Chemist and Acting Senior Chemist, has been appointed to be Senior Chemist, S.S. & F.M.S., with effect from 1st January 1939.

Leave.

Mr. T. D. Marsh, Senior Agriculturist, has been granted 150 days leave from 7th February to 6th July 1941 inclusive.

Mr. N. C. E. Miller, Entomologist, has been granted 150 days leave from 17th February to 16th July 1941 inclusive.

From the Districts.

Owing to the embodiment of the volunteers and consequent temporary reduction in the staff of the Field Branch of the Department it is regretted that the usual review of field activities under the above title is not available for publication in this issue.

Leaflets.

Two additions to the leaflets of the Department are in course of preparation and will be available for distribution before the end of this month. They are "Papaya", No. 22 in the Agricultural Series, and a leaflet on Pig Keeping.

Leaflets are available for distribution in Malaya only and can be obtained free on application to the Department of Agriculture, Kuala Lumpur.

FERTILIZER PRICES, MARCH, 1941.

The following are the prices current for the month of March, 1941, of the more important fertilizers of which stocks are available.

	per ton $	
Nitrate of soda	125	
Muriate of potash	200	
Rock phosphate (Christmas Island)	37	($35 Singapore).
Lime	20	

Quotations are *ex* warehouse, Port Swettenham, Klang, Singapore and Penang.

Supplies of sulphate of ammonia, superphosphate, basic slag, calcium cyanamide, sulphate of potash, and rock phosphate (Gafsa) are not available.

Statistical.

MARKET PRICES.

February, 1941.

Rubber. — Singapore prices remained relatively stable at the lower level established in January. No. 1. X Ribbed Smoked Sheet opened at 36⅝ cents per lb., and, after weakening, rose to 37⅜ cents on the 13th February: it fell steadily to 35¾ on the 20th, but improved to close at 36¼ cents.

The average of daily quotations for the month was 36.36 cents per lb., as compared with 37.07 cents in January. The London price rose to 13⅛ pence per lb., averaging 12.73 pence, and New York averaged 20.29 cents gold, as compared with 12.40 pence and 19.75 cents gold in January.

Prices paid for small-holders' rubber at three centres during the month are given in Table 1.

Table 1.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, February, 1941.

(Dollars per picul of 133 1/3 lbs.)

Grades	Kuala Kangsar, Perak				Kuala Pilah, Negri Sembilan			Batu Pahat, Johore.		
	5	12	19	26	6	13	27	12	19	26
Smoked Sheet ...	42.67	42.54	43.90	41.90	—	44.25	42.80	42.50	—	41.60
Unsmoked Sheet ...	40.00	—	39.52	40.00	42.00	42.00	41.50	40.50	40.00	39.60
Scrap ...	—	—	—	—	—	—	—	—	—	—

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8 per ton.

Transport from Batu Pahat to Singapore by lorry, excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

No purchases of rubber at Batu Pahat on the 5th February, and at Kuala Pilah on the 20th February.

Table II.

Singapore Prices of Various Agricultural Products.

Product	February, 1941			Jany. 1941	Average Price 1940
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Copra :					
Sundried ...	2.50	2.40	2.47	2.40	3.08
Mixed ...	2.25	2.15	2.22	2.15	2.76
Coconut Oil ...	—	—	7.00	7.00	8.29
Copra Cake No. 1 ...	‡	‡	‡	2.00	1.43
No. 2 ...	1.60	1.60	1.60	1.70	‡
Pineapples, Canned :*					
G.A.Q. : Cubes ...	4.85	4.85	4.85	4.85	4.85
Sliced ...	4.80	4.80	4.80	4.80	4.80
Tall ...	4.95	4.95	4.95	4.95	4.95
Golden : Cubes ...	5.45	5.45	5.45	5.45	5.45
Sliced ...	5.40	5.40	5.40	5.40	5.40
Tall ...	5.55	5.55	5.55	5.55	5.55
Coffee :					
Liberian ...	15.50	15.50	15.50	15.50	16.10
Excelsa ...	12.50	12.50	12.50	12.00	13.69
Robusta ...	9.00	9.00	9.00	8.83	8.92
Palembang ...	19.00	17.25	17.50—18.81	14.15—16.15	13.00†
Sourabaya ...	17.50	16.00	16.31—17.31	16.10—18.10	14.80†
Arecanuts :					
Best ...	6.00	5.70	5.92	5.86	5.65
Medium ...	5.75	5.25	5.63	5.31	5.24
Mixed ...	5.25	4.50	5.04	4.94	4.88
Splits ...	5.75	4.25	4.44— 5.69	5.50— 7.15	6.33†
Red Whole ...	6.00	4.75	4.81— 5.81	6.30— 8.35	6.67†
Sliced ...	10.50	8.00	8.06—10.31	8.25—11.05	10.79†
Pepper :					
Singapore Black ...	6.75	6.50	6.62	6.69	7.29
Singapore White ...	13.25	13.00	13.06	13.38	‡
Muntok White ...	13.50	13.50	13.50	13.69	13.51
Nutmegs :					
110's ...	23.50	23.50	23.50	21.00	26.11
80's ...	24.00	24.00	24.00	23.00	30.65
Penang, dried¶ ...	‡	‡	‡	16.00	21.00
Mace :					
Siouw ...	‡	‡	‡	‡	‡
Amboina ...	40.00	38.00	38.50	37.00	39.85
Penang, dried¶ ...	‡	‡	‡	40.00	63.50
Cloves :					
Zanzibar ...	42.00	41.00	41.75	40.67	‡
Amboina ...	45.00	42.00	43.25	42.67	‡
Penang, dried¶ ...	‡	‡	‡	50.00	72.00

* per case of 48 cans of 1½ lbs. each.

† Highest of the average monthly range quotations.

¶ Penang prices.

‡ Not quoted.

Product	February, 1941			Jan. 1941	Average Price 1940
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Gambier:					
Block ...	‡	‡	‡	‡	‡
No. 1 Cube ...	14.50	12.75	14.06	13.44	15.00
Sago:					
Pearl ...	8.00	7.30	7.64	7.40	7.79
Flour, Sarawak Fair ...	4.35	4.30	4.31	4.38	4.95
Tapioca:					
Flake Fair ...	6.25	6.25	6.25	6.31	8.08
Seed Pearl ...	7.50	7.40	7.40	7.36	9.45
Medium Pearl ...	7.35	7.30	7.31	7.55	9.07

Palm Oil. — The following prices of palm oil are quoted in a letter from the Malayan Information Agency dated 16th January, 1941. The prices are those allocated to primary wholesalers and large trade users during the period 30th December 1940 to 1st February 1941.

Softs, semis, hards, Lagos, Red Sherbro: £20.15 per ton, c.i.f. in casks to be returned; £20.5 per ton c.i.f. in loan drums; £19.5 per ton c.i.f. in bulk S.O.G.P.A. contract No. 21 allowances).

Local sales of palm oil in sellers' drums were made during February at the following prices per ton:—

	per cent. f.f.a.	$	
Bleached oil	5	127.50	f.o.b. Singapore
	6	126.00	,, ,,
Unbleached	5	120.00	,, Port Swettenham
	5	125.00	,, Singapore
	5	130.00	,, ,, (delivery July)
	6	123.00	,, ,,
	8	117.00	,, ,,

Rice. — The Singapore average wholesale prices of rice per picul in January were as follows:— Thailand No. 2 Ordinary (3rd Grade "A") $6.92, Thailand No. 1 Broken (White) $6.42, Thailand No. 2 Broken (White) $6.17, Rangoon No. 1 (S.Q. Meedone) $7.12, Rangoon Parboiled No. 2 (Milchar No. 2) $5.87, Saigon No. 1 (Long Grain) (Annam White Rice No. 1) $6.42.

The December average retail prices in cents per gantang (gallon) of No. 2 Thailand rice were: Singapore 46½, Penang and Malacca not quoted, as compared with Singapore 38, Penang 36, Malacca not quoted, in November.

The average declared trade value of imports during December was $5.91 per picul, as compared with $5.47 in November and $5.48 in October. The average for the year was $4.74, as compared with $3.75 for the year 1939.

Padi. — The Government Rice Mills, Perak, are paying a guaranteed price of $2.50 per picul for padi, plus a bonus of 10 cents per picul for pure strain S.K. 48 padi. There were no purchases of padi at the Government Rice Mill, Temerloh, Pahang.

Retail prices of padi in cents per gantang (gallon) were as follows:—Kedah 9½, Perak 12 to 18, (Krian 9½), Negri Sembilan 9 to 15 (Seremban 22), Pahang: Temerloh 13 to 15, Bentong 21 to 22, Kelantan 12, Brunei, *kampong* 10 to 20, town 20 to 22, Labuan: *kampong* 14, town 16.

Tea. — There are no London tea sales.

The latest Colombo prices available, quoted from *The Ceylon Tea Market Report* of 25th February 1941 of the Colombo Brokers' Association are as follows, in rupee cents per lb.: High Grown Rs. 1.14, Medium Grown 92, Low Grown 85.

Cardamoms. — Green cardamoms were quoted in *The Ceylon Chamber of Commerce Weekly Report* of 24th February 1941 from Rs. 2.05 to Rs. 2.28 per lb.

Derris. — Demand was well maintained and prices in Singapore remained at the January levels. Average prices per picul were: $9 to $11 for roots sold on a basis of ether extract; $18 to $22.50 for roots with 4 to 5 per cent. rotenone content, rising to $27 to $28.50 for 7 to 9 per cent. rotenone.

Tobacco. — Prices of prepared tobacco per picul in Kelantan were 1st quality $100 to $110, 2nd quality $70 to $90, 3rd quality $50 to $75. Prices of dried leaf per picul were as follows:— Perak Central 1st quality $35 to $45, 2nd quality $18 to $38, 3rd quality $12 to $28; Negri Sembilan 2nd quality $24 to $30, 3rd quality $18; Kedah 1st quality $43 to $45; Pahang $24 to $30, prepared tobacco 60 to 90 cents per kati; Selangor $1.25 to $1.50 per kati cut tobacco.

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore daily prices for copra, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports and certain coffee prices are kindly supplied by Guthrie & Co., Ltd., Kuala Lumpur, local palm oil prices by Whittall & Co., Kuala Lumpur, the Singapore prices of imported coffee and arecanuts by Lianqui Trading Company of Singapore, and Singapore derris prices by Hooglandt & Co., Singapore.

1 picul = 133 1/3 lbs. The dollar is fixed at 2s. 4d.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Trafalgar Square, London, W.C.2.

MALAYAN AGRICULTURAL EXPORTS, DECEMBER, 1940.

Product	Net Exports in Tons			
	Year 1939	Year 1940	December 1939	December 1940
Arecanuts ...	38,489	43,915	2,050	2,468
Coconuts fresh†‡ ...	97,275†	131,469†	6,831†	20,199†
Coconut oil‡ ...	61,360	69,446	5,096	6,080
Copra‡ ...	34,420	9,904*	8,971*	111
Copra cake ...	10,707	1,215*	254*	4,096*
Gambier, all kinds ...	1,572	821	169	49
Palm kernels ...	10,774	9,219	1,761	441
Palm oil ...	59,712	55,990	4,600	7,252
Pineapples, canned ...	65,802	40,243	3,957	5,484
Rubber¶ ...	361,484¶	549,327¶	32,755¶	54,766¶
Sago,—flour ...	9,583	2,525	1,459	640
,, —pearl ...	3,883	4,848	476	841
,, —raw ...	4,435*	4,816*	190*	156*
Tapioca,—flake ...	1,068	762	129	82
,, —flour ...	2,706*	2,649*	773*	419*
,, —pearl ...	18,277	17,004	831	1,314
Derris ...	1,356	1,258	149	160
‡Copra equivalent ...	136,075	108,468	553*	10,648

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS

(In long tons, as declared by Estates)

Month 1941	Palm Oil			Palm Kernels		
	F.M.S.	U.M.S.	Malaya	F.M.S.	U.M.S.	Malaya
January ...	1,872.7	1,221.4	3,094.1	170.3	150.0	320.3
Total January 1940	2,007.6	2,474.0	4,481.6	434.3	497.0	931.3
Total for the year 1940 ...	29,875.2	28,096.9	57,972.1	4,513.1	5,098.1	9,611.2

Stocks on estates as at 31st January, 1941. were: palm oil 5,666 tons, palm kernels 540 tons.

ACREAGES OF TAPPABLE RUBBER ACTUALLY TAPPED AND NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST JANUARY, 1941.

STATE OR TERRITORY	Estimated Acreages of Tappable Rubber (9)+(11)	ACREAGES OF TAPPABLE RUBBER NOT TAPPED				Area of tappable rubber never been tapped (b)		Total area not tapped (3) + (5) (c)		TOTAL AREA TAPPED DURING THE MONTH		Area of tappable rubber rested under rotational systems (c)	
		On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)									
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of 7) to (2)	Acreage	Percentage of (9) to (2)	Average	Percentage of (11) to (2)	Acreage	Percentage of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
S.S.—													
Province Wellesley ...	42,342	nil	nil	5,578	13.2	305	0.7	5,578	13.2	36,764	86.8	8,149	19.2
Malacca ...	111,967	309	0.3	8,796	7.8	489	0.4	9,105	8.1	102,862	91.9	16,504	14.7
Penang ...	2,595	nil	nil	616	23.7	35	1.3	616	23.7	1,979	76.3	60	2.3
Singapore ...	29,536	3,477	11.8	5,104	17.3	395	1.3	8,581	29.1	20,955	70.9	1,864	6.3
Total S.S. ...	186,440	3,786	2.0	20,094	10.8	1,224	0.7	23,880	12.8	162,560	87.2	26,577	14.3
F.M.S.—													
Perak ...	275,369	250	0.1	17,190	6.2	3,495	1.3	17,440	6.3	257,929	93.7	30,917	11.2
Selangor ...	304,047	989	0.3	14,963	4.9	3,179	1.0	15,952	5.2	288,095	94.8	32,654	10.7
Negri Sembilan ...	251,106	1,895	0.8	25,706	10.2	4,205	1.7	27,601	11.0	223,505	89.0	22.713	9.0
Pahang ...	85,336	5	0.0	8,253	9.7	3,034	3.6	8,258	9.7	77,078	90.3	4,814	5.6
Total F.M.S. ...	915,858	3,139	0.4	66,112	7.2	13,913	1.5	69,251	7.6	846,607	92.4	91,098	9.9
U.M.S.—													
Johore ...	469,067	7,317	1.6	45,943	9.8	22,309	4.8	53,260	11.4	415,870	88.6	49,666	10.6
Kedah ...	195,394	4,314	2.2	8,564	4.4	3,702	1.9	12,878	6.6	182,516	93.4	26,022	13.3
Kelantan ...	30,377	403	1.3	4,825	15.9	835	2.7	5,228	17.2	25,149	82.8	3,150	10.4
Trengganu (d) ...	4,817	nil	nil	nil	nil	nil	nil	nil	nil	4,817	100.0	1.515	31.5
Perlis (e) ...	1,329	nil	nil	345	26.0	76	5.7	345	26.0	984	74.0	232	17.5
Brunei ...	6,179	nil	nil	1,201	19.4	288	4.7	1,201	19.4	4,978	80.6	911	14.7
Total U.M.S. ...	707,163	12,034	1.7	60,878	8.6	27,210	3.8	72,912	10.3	634,251	89.7	81,496	11.5
Total MALAYA ...	1,809,461	18,959	1.1	147,084	8.1	42,347	2.3	166,043	9.2	1,643,418	90.8	199,171	11.0

Notes.—(*a*) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) The acreage shown in column (7) is included in columns (3) and (5).

(*c*) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(*d*) Registered companies only.

MALAYAN RUBBER STATISTICS Table I.

ACREAGE, STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY, 1941, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports during the month		Imports January 1941		Exports including re-exports during the month		Exports including re-exports January 1941		Stocks at end of month			Consumption 3	
	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. 1941	during the month	Jan. 1941	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. 1941
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	7,414	18,940	17,406	17,406	8,952	8,952	Nil	Nil	Nil	Nil	14,958	14,050	14,958	14,050	...	4,469	19,086	149	149
Johore ...	...	2,493	6,679	7,067	7,067	7,040	7,040	Nil	19	Nil	19	3,726	10,571	3,726	10,571	...	2,003	6,998	...	...
Kedah ...	...	656	4,397	4,413	4,413	1,984	1,984	Nil	Nil	Nil	Nil	1,422	4,769	1,422	4,769	...	566	4,693	...	...
Perlis ...	...	39	27	20	20	37	37	Nil	Nil	Nil	Nil	Nil	71	Nil	71	...	27	25	...	...
Kelantan ...	...	270	453	443	443	549	549	Nil	Nil	Nil	Nil	155	925	155	925	...	215	420	...	...
Trengganu ...	...	41	121	185	185	337	337	Nil	Nil	Nil	Nil	5	520	5	520	...	48	111	...	...
Brunei ...	...	1	43	76	76	80	80	...	...	...	...	...	152	...	152	...	5	43	...	...
Total Malay States ...	...	10,914	30,660	29,610	29,610	18,979	18,979	Nil	19	Nil	19	20,266	31,058	20,266	31,058	...	7,333	31,376	149	149
S. SETTLEMENTS :—																				
Malacca ...	...	2,436	1,695	1,721	1,721	1,078	1,078	Nil		Nil		3,807		3,807		...	2,724	1,778	...	...
Province Wellesley ...	...	1,963	796	695	695	285	285	Nil		Nil		11,151		11,151		...	2,754	904	...	...
Penang ...	2,809	4,046	15	28	28	153	153	2,045	28,931	2,045	28,931		Nil		Nil	3,104	5,449	20	...	...
Singapore ...	10,054	9,864	270	171	171	98	98	24,878		24,878		29,414		29,414		7,733	20,877	290	25	25
Labuan ...	...	38	Nil	Nil	Nil	14	14	62		62		Nil		Nil		...	19	Nil	...	...
Total Straits Settlements ...	12,863	18,347	2,776	2,615	2,615	1,628	1,628	26,985	28,931	26,985	28,931	44,372	Nil	44,372	Nil	10,837	31,823	2,992	25	25
Total Malaya ...	12,863	29,261	33,436	32,225	32,225	20,607	20,607	26,985	28,950	26,985	28,950	64,638	31,058	64,638	31,058	10,837	39,156	34,368	174	174

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	P.We'sly M'cca, Labuan & Brunei	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	3,466	19,649	4,920	4,880	985	309
WET RUBBER	1,003	1,228	529	622	1,045	257
TOTAL ...	4,469	20,877	5,449	5,502	2,003	566

TABLE III
FOREIGN EXPORTS

PORTS	For month	Jan. 1941
29	30	31
Singapore ...	42,130	42,130
Penang ...	14,506	14,506
Port Swettenham	8,002	8,002
Malacca ...	Nil	Nil
TOTAL ...	64,638	64,638

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	Jan. 1941
32	33	34
Malay States ...	51,253	51,253
Straits Settlements	4,107	4,107
MALAYA ...	55,360	55,360

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S and F.M.S., at Singapore on 26th February, 1941

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1941.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hrs.	hrs.	
Kuala Lumpur Aerodrome Selangor ...	91.6	72.3	81.9	95	69	84	75	84.3	85.6	6.30	160.0	2.59	15	13	5	13	—	175.75	5.67	47
Port Swettenham Aerodrome, Selangor ...	88.5	71.6	80.1	91	70	85	74	84.4	85.3	7.88	200.2	1.19	19	16	8	—	—	189.10	6.10	51
Sitiawan, Perak ...	88.9	73.1	81.0	91	71	85	75	82.8	83.5	8.78	223.0	2.65	17	12	4	—	—	222.70	7.18	61
Ipoh Aerodrome, Perak ...	90.7	72.2	81.5	95	70	85	75	83.6	84.5	6.54	166.1	2.08	16	14	4	—	1	222.15	7.17	60
Temerloh, Pahang ...	87.9	72.5	80.2	92	70	80	76	84.0	85.5	6.15	156.2	1.39	21	17	3	9	—	179.35	5.79	49
Kuala Lipis, Pahang ...	87.8	71.9	79.9	92	69	79	75	82.1	83.7	6.20	157.5	1.09	18	13	1	26	—	174.10	5.62	47
Kuala Pahang, Pahang ...	84.4	75.8	80.1	86	70	81	80	83.5	84.9	12.50	317.5	4.07	16	14	—	—	1	204.95	6.61	55
Kallang Aerodrome, S'pore ...	85.8	74.9	80.3	90	73	80	77	81.4	83.0	13.22	335.8	1.69	25	23	5	—	—	154.50	4.98	41
Bayan Lepas Aerodrome Penang ...	88.3	73.2	80.7	91	70	85	75	84.4	85.0	2.75	69.9	0.91	10	9	—	—	—	250.70	8.09	69
Malacca Town, Malacca ...	85.9	73.6	79.7	90	70	80	76	81.8	83.4	6.02	152.9	1.21	17	16	6	—	2	186.65	6.02	50
Kluang, Johore ...	86.7	71.8	79.3	92	68	78	75	80.4	81.6	11.06	280.9	2.14	22	21	2	9	—	143.05	4.61	38
Mersing, Johore ...	83.5	73.7	78.6	86	70	78	79	80.5	81.1	12.91	327.9	2.33	19	18	1	—	—	198.65	6.41	53
Alor Star, Kedah ...	90.4	71.9	81.1	94	69	87	75	83.6	85.4	2.97	75.4	1.49	8	8	2	—	—	257.75	8.31	70
Kota Bahru, Kelantan ...	86.0	72.8	79.4	89	69	82	78	82.1	83.0	6.13	155.7	1.64	15	13	1	2	—	224.00	7.23	61
Kuala Trengganu, Trengganu	84.9	73.5	79.2	87	70	75	78	81.5	83.1	8.87	225.3	3.89	17	14	1	10	—	218.20	7.04	59
Labuan ...	86.5	77.3	81.9	92	73	81	80	88.7	88.1	1.01	25.7	0.45	5	4	—	—	—	273.60	8.83	74
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	71.5	62.0	66.7	78	59	65	64	70.8	71.3	12.74	323.6	2.34	22	21	2	19	—	135.70	4.38	37
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.6	55.9	64.3	77	48	68	63	69.2	69.3	5.29	134.4	0.77	20	17	2	—	—	161.15	5.20	44
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	72.5	59.2	65.9	76	52	65	64	*	*	4.60	116.8	0.73	19	16	1	—	5	173.05	5.58	47

* Not recorded.